PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

PRINS, A., W.
c/o Vereenigde
Nieuwe Parklaan 97
NL-2587 BN Den Haag
PAYS-BAS

Date of mailing (day/month/year)
10 January 2002 (10.01.02)

Applicant's or agent's file reference
A00-40071/JV

IMPORTANT NOTIFICATION

International application No.
PCT/NL00/00518

International filing date (day/month/year)
21 July 2000 (21.07.00)

1. The following indications appeared on record concerning:

[ ] the applicant [ ] the inventor [X] the agent [ ] the common representative

Name and Address
VOLMER, J., C.
Exter Polak & Charlouis B.V.
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NL-2280 GE Rijswijk
Netherlands

State of Nationality:
State of Residence:
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Facsimile No.: 070 4145499
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[X] the person [ ] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address
PRINS, A., W.
c/o Vereenigde
Nieuwe Parklaan 97
NL-2587 BN Den Haag
Netherlands

State of Nationality:
State of Residence:
Telephone No.: 070 416 67 11
Facsimile No.: 070 416 67 99
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
R. Chrem
Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TRE TY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

PRINS, A., W.
c/o Vereenigde
Nieuwe Parklaan 97
NL-2587 BN Den Haag
PAYS-BAS

Date of mailing (day/month/year)
10 January 2002 (10.01.02)

Applicant's or agent's file reference
A00-40071/JV

IMPORTANT NOTIFICATION

International application No.
PCT/NL00/00518

International filing date (day/month/year)
21 July 2000 (21.07.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
FOUNTAIN TECHNOLOGIES B.V.
Rivium Quadrant 94
NL-2909 LC Capelle aan den IJssel
Netherlands

State of Nationality: NL
State of Residence: NL
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address
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Netherlands

State of Nationality: NL
State of Residence: NL
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
R. Chrem

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 26 March 2001 (26.03.01)	
International application No. PCT/NL00/00518	**Applicant's or agent's file reference** A00-40071/JV
International filing date (day/month/year) 21 July 2000 (21.07.00)	**Priority date** (day/month/year) 23 July 1999 (23.07.99)
Applicant HOOGLAND, Hendricus, Antonius	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

16 January 2001 (16.01.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Zakaria EL KHODARY
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

INTERNATIONAL SEARCH REPORT

Int[redacted]nal Application No
PCT/NL 00/00518

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65G1/06 B65G1/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 123 517 A (WINDAU THOMAS H) 23 June 1992 (1992-06-23) abstract column 3, line 10 -column 43; figures 1,2,5,10,13,19 198/463.3	1,16
A	US 5 882 164 A (RAPELI PEKKA E ET AL) 16 March 1999 (1999-03-16) column 12, line 23 -column 14, line 15 414/141.3	1,16
A	US 3 749 268 A (MACOMBER F ET AL) 31 July 1973 (1973-07-31) 414/499	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 October 2000	27/10/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Beernaert, J

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

rmation on patent family members

Interna[illegible]pplication No
PCT/NL 00/00518

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5123517 A	23-06-1992	NONE	
US 5882164 A	16-03-1999	FI 943763 A	17-02-1996
		AT 179951 T	15-05-1999
		AU 3224795 A	07-03-1996
		DE 69509661 D	17-06-1999
		DE 69509661 T	02-12-1999
		DK 776312 T	15-11-1999
		EP 0776312 A	04-06-1997
		ES 2133792 T	16-09-1999
		WO 9605131 A	22-02-1996
US 3749268 A	31-07-1973	NONE	

INTERNATIONAL SEARCH REPORT

rmation on patent family members

Interna al Application No
PCT/NL 00/00518

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5123517 A	23-06-1992	NONE	
US 5882164 A	16-03-1999	FI 943763 A	17-02-1996
		AT 179951 T	15-05-1999
		AU 3224795 A	07-03-1996
		DE 69509661 D	17-06-1999
		DE 69509661 T	02-12-1999
		DK 776312 T	15-11-1999
		EP 0776312 A	04-06-1997
		ES 2133792 T	16-09-1999
		WO 9605131 A	22-02-1996
US 3749268 A	31-07-1973	NONE	

PATENT COOPERATION TREATY

Stean ok

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

VOLMER, J.C.
Exter Polak & Charlouis B.V.
Postbus 3241
2280 GE RIJSWIJK
PAYS-BAS

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	14.11.2001
Applicant's or agent's file reference A00-40071/JV	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00518	21/07/2000	23/07/1999

Applicant
FOUNTAIN TECHNOLOGIES B.V. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Loeper, S Tel.+49 89 2399-2569

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
A00-40071/JV		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00518	21/07/2000	23/07/1999
International Patent Classification (IPC) or national classification and IPC B65G1/06		
Applicant FOUNTAIN TECHNOLOGIES B.V. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
16/01/2001	14.11.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Samwel, P Telephone No. +49 89 2399 2099

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL00/00518

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-9 as originally filed

Claims, No.:

1-16 as originally filed

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-16
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-16
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-16
	No:	Claims	

2. Citations and explanations
   see separate sheet

1) Reference is made to the following documents:

D1: US-A- 5 123 517
D2: US-A- 3 749 268

2) The only independent claim 1 deals with a device for storage and conveyance of bulky holders. The closest prior art is D2 and the subject-matter of claim 1 differs from D2 in that a vertical movement is possible to convert the holders from one to the other tier. Vertical movement for transport is known as such (see D1), but here the transport is only foreseen along the tier and therefore it is considered not obvious for the man skilled in the art to come from D1 and D2 to the subject-matter of claim 1.

3) Contrary to the requirements of Ruke 5.1.(a) ii PCT, the relevant background art disclosed in the documents D1, D2 are not mentioned in the discription, nor are these documents identified therein.

4) Independent claim 1 is not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D2) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

(12) INTERNATIONAL [redacted]LICATION PUBLISHED UNDER THE PAT[redacted]COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 February 2001 (01.02.2001)

PCT

(10) International Publication Number
WO 01/07345 A1

(51) International Patent Classification[7]: B65G 1/06, 1/08

(21) International Application Number: PCT/NL00/00518

(22) International Filing Date: 21 July 2000 (21.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1012682 23 July 1999 (23.07.1999) NL

(71) Applicant *(for all designated States except US)*: FOUNTAIN TECHNOLOGIES B.V. [NL/NL]; Rivium Quadrant 94, NL-2909 LC Capelle aan den IJssel (NL).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: HOOGLAND, Hendricus, Antonius [NL/NL]; Ganimedesstraat 40, NL-1562 ZN Krommenie (NL).

(74) Agent: VOLMER, J., C.; Exter Polak & Charlouis B.V., P.O. Box 3241, NL-2280 GE Rijswijk (NL).

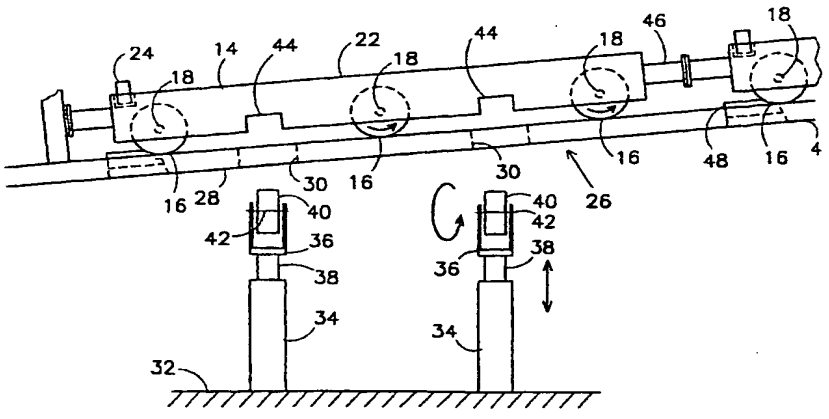
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DEVICE FOR STORAGE AND CONVEYANCE OF BULKY HOLDERS



(57) Abstract: The invention relates to a device for storage and conveyance of bulky holders (C), comprising at least one tier (32), each tier comprising at least one conveyance circuit (2) for the holders (C), and each conveyance circuit (2) comprising at least two longitudinal paths (4, 6) disposed substantially parallel to each other, for conveyance of the holders (C) in the direction of the longitudinal paths (4, 6), which longitudinal paths (4, 6) each define a first predetermined number (N) of adjoining holder positions for the holders (C) while two adjacent longitudinal paths (4, 6) of a conveyance circuit (2) slope from the same end in opposite directions, and in which transverse tracks situated at the opposite ends of the longitudinal paths and movable at least in the vertical direction are also provided, for conveyance of the holders (C) in the direction of the transverse tracks, which transverse tracks can transfer the holders (C) to and from the longitudinal paths (4, 6), and also comprising a second predetermined number ($M \leq 2*N - 1$) of carriers (14) which are movable along the longitudinal paths and transverse tracks and are designed to take one or more holders (C), lifting means (34) being provided for moving the transverse tracks in the vertical direction.

WO 01/07345 A1

Device for storage and conveyance of bulky holders

The present invention relates to a device for storage and conveyance of bulky holders, in particular containers.

Container terminals are generally known and are used for the temporary storage and subsequent distribution of containers, which are brought into a seaport in large numbers in, for example, container ships, and are then transported further by rail in goods trains, by road in lorries or on waterways in smaller vessels. In order to permit temporary storage of the large quantity of containers, said containers are stacked on top of one another in rows spaced apart in a storage yard, generally with the aid of mobile gantry cranes operated by crane drivers. The free space between the rows is necessary for the tracks along which the mobile cranes can move. When a particular container from such a stack has to be transported further, the containers stacked on top of this particular container first have to be moved to a free position before the particular container can be removed from the stack and delivered for further distribution to a generally centrally situated discharge point. Such movements take a relatively large amount of time. Moreover, it is found in practice that a container, once stored, is often moved about ten times before it is removed from the storage site. However, each movement usually has to be paid for, which incurs additional costs. Furthermore, the space is being used inefficiently, since aisles are needed between the rows for the gantry cranes.

The same problem occurs in distribution centres, where pallets or other holders filled with goods are stored temporarily on racks comprising several levels. Here again, aisles have to be present between the racks and at their ends, for forklift trucks or the like which supply and remove the pallets. A large amount of floor space is therefore needed. However, the pallets are not stacked directly on top of one another and can therefore be removed individually from the racks.

A solution known from the trade is described in, for example, WO 94/06708, which discloses a storage system for bulky holders, in particular containers used in aircraft. This system consists of a

number of storage levels, each consisting of mutually parallel, individually operable endless horizontal longitudinal conveyors with storage bays for the stored holders. On each level, provision is made for (endless) transverse conveyors at least at the two ends of the horizontal longitudinal conveyors. Aisles between the horizontal longitudinal conveyors are therefore not required.

A disadvantage of such a system is that separate drives, such as chain drives, are needed for each conveyor, as are separate intermediate parts, for example roller conveyors, for transferring a container from a longitudinal conveyor to a transverse conveyor.

EP-A-0 145 871 also discloses a device for the storage and conveyance of containers, in which a so-called "Doppelfahrwagen" (double carriage), which can travel along a network of rails provided with crossover points, is used. Such a carriage is provided with a first travelling mechanism comprising several sets of first travelling wheels, for movement in a first direction, and with a second travelling mechanism comprising several sets of second travelling wheels, for movement in another direction, generally transversely to the first direction, the travelling mechanisms being adjustable in height relative to each other, so that when the first travelling mechanism is resting on the rails and the second has been retracted the carriage with load can move in the first direction, and vice versa. The change in direction of movement can be made at the crossover points. This means that turntables, bends and the like in the network are not needed. These carriages known from EP-A 0 145 871 are provided with a lifting table, so that no additional aids, such as cranes and the like, are needed for loading and unloading.

Disadvantages of this known system are that drives are needed for moving the carriages, and that each carriage has to be provided with a double travelling mechanism.

The object of the present invention is to reduce the abovementioned problems, in particular to limit the number of drives and in doing so to keep the construction relatively simple, while the possibility of automation and also efficient utilization of space are retained.

To that end, the present invention provides a device for storage and conveyance of bulky holders, comprising at least one tier, each tier comprising at least one conveyance circuit for the holders, and each conveyance circuit comprising at least two

longitudinal paths disposed substantially parallel to each other, for conveyance of the holders in the direction of the longitudinal paths, which longitudinal paths each define a first predetermined number (N) of adjoining holder positions for the holders, while two adjacent longitudinal paths of a conveyance circuit slope from the same end in opposite directions, and also comprising transverse tracks situated at the opposite ends of the longitudinal paths and movable at least in the vertical direction, for conveyance of the holders in the direction of the transverse tracks, which transverse tracks can transfer the holders to and from the longitudinal paths, and also comprising a second predetermined maximum number ($M \leq 2*N - 1$) of carriers which are movable along the longitudinal paths and transverse tracks and are designed to take one or more holders, lifting means being provided for moving the transverse tracks in the vertical direction.

The device according to the invention comprises at least one tier, and preferably several tiers, situated above one another on a suitable frame of, for example, concrete columns with cross beams. Holders such as pallets or containers can be stored and conveyed on each tier. For this purpose, a conveyance circuit is provided on each tier, along which the stored holders can be conveyed one behind the other with the aid of the movable carriers, substantially under the influence of gravity. Each conveyance circuit comprises at least two, and preferably also two, longitudinal paths which run parallel to each other, but slope from one end in opposite directions. Transverse tracks which are movable in the vertical direction form connecting routes for the holders at the ends of the longitudinal paths, so that the whole system forms a closed circuit. The device is further provided with carriers which are movable along the longitudinal paths and transverse tracks. The length of a longitudinal path is such that a predetermined number (N) of carriers with holders fit on it. The total number of carriers (M) is then less than or equal to $2*N - 1$, so that a free position in the conveyance circuit is present in each case. This makes movement possible. Since the longitudinal paths are disposed in a sloping manner, an angle of inclination of 0.2° being sufficient for 8 standard 40-foot containers disposed crosswise, the containers disposed upon the carriers, as a result of gravity, have the tendency to move by themselves towards the lowest point, so that additional drives are not needed. In order to

transfer a carrier situated at one end of a longitudinal path to an adjoining longitudinal path, the transverse tracks forming the transverse connection at the ends of the longitudinal paths are movable in the vertical direction, so that the carrier is temporarily lifted up from a longitudinal path and is moved along the transverse tracks, preferably again under the influence of gravity, if the transverse tracks are provided with a suitable angle of inclination. Thereafter, the carrier is allowed to rest upon the adjoining longitudinal path again, so that further movement along the latter is possible. The lifting means, for example hydraulic piston/cylinder assemblies, are provided for this vertical movement, which is accompanied by a slight tilt if necessary.

The operation of the device is relatively simple. A tier with 2*N positions for holders and 2*N-1 carriers is filled with holders, in principle one on each carrier. However, the carriers may be arranged in such a way that several holders with smaller dimensions fit on them. When a certain holder has to be transported further from there, the circuit in question is put into operation, the carriers being allowed to circulate until the holder in question is situated at a discharge point of a longitudinal path, where said holder can be removed from the circuit. The holder is lifted off a carrier using suitable means, for example a forklift truck. A new holder can be placed on the empty carrier and stored in this way.

The carriers are advantageously mobile along the longitudinal paths, and to that end comprise rows of wheels which are spaced apart and are rotatable in the longitudinal direction of the longitudinal paths. Although in principle a limited number of wheels (e.g. 4) will suffice, it is preferable to use a large number of relatively small wheels, so that if one wheel becomes defective, the entire system does not come to a standstill. The wheels may be disposed on a common axle or otherwise.

The end sections of the longitudinal paths preferably comprise guides for the wheels, which guides are spaced apart, for example guides with an L-profile or an inverted T-profile, such as rails, or guides in the form of a channel (inverted U-profile), the space between the guides being at least partially open, for a reason to be described in further detail.

The transverse tracks are advantageously composed of rotatable

discs or wheels which are disposed one after the other in rows and are rotatable about a horizontal shaft and in the longitudinal direction of the transverse tracks or wheels, along which the carriers are movable in the longitudinal direction of the transverse tracks. According to a further embodiment, each disc is mounted on the head of a piston/cylinder assembly, which piston/cylinder assemblies form the lifting means for the transverse tracks and are movable from the bottom vertically upwards into the open spaces between the guides of the end positions of the longitudinal paths. It will be understood that the stroke of the piston/cylinder assemblies disposed at the end of the longitudinal paths, where the latter have the greatest mutual height difference, must be greater than that of the piston/cylinder assemblies at the other end. In order to ensure that a carrier can roll correctly over the discs, guides such as inverted U-profiles are advantageously provided between the rows of wheels on the underside of the carrier, for accommodating and guiding the rotatable discs, which guides extend in the transverse direction of the carrier.

Since the carriers are positioned in a virtually horizontal position by means of the transverse tracks, before the carriers can be transferred from one longitudinal path by way of the transverse tracks to an adjoining longitudinal path, blocking means are advantageously provided in the longitudinal paths, in particular for the carriers in the penultimate positions, so that sufficient distance is present between the holders on the last (lowest) carrier and penultimate carrier to allow the horizontal positioning. Blocks which can be lowered in the surface are an example of such blocking means, which are actuated, for example, when sensors detect the presence of a carrier in the last position. Spacers between the carriers can produce the same effect, but lead to an overall lengthening and widening of the conveyance circuit with the same number of carriers.

The device according to the invention advantageously has for each conveyance circuit a supply point for supplying new holders when an empty carrier is present, and a removal point for removing a stored holder. These points are advantageously situated at the same ends of the longitudinal paths, in other words, at the head end, so that the holders can be supplied and removed there using one and the same aid, such as a forklift truck. The supply point

and removal point of a conveyance circuit are advantageously situated at the ends of the longitudinal paths, where the height difference is minimal.

For an automated device according to the invention, detection points are advantageously present both at the supply point and at the removal point, for detection and identification of the holders. The detection system in question, for example a camera identification system, is dependent upon the type of coding present on the holders. When a new holder is fed into a conveyance circuit, the data of the holder are detected and stored in a computer, together with the data of the conveyance circuit concerned. The computer forms part of the control system of the device. When a particular holder has to be removed from storage, the circuit concerned is put into operation, until through circulation the presence of this particular holder is detected at the removal point.

Several adjoining conveyance circuits, each consisting of two longitudinal paths, are advantageously present for each tier.

The device can also be provided with a further conveyor, which moves along each supply and removal point of a conveyance circuit, and on which lifting means for conveying, supplying and removing the holders are disposed in a movable manner.

The invention also relates to a container terminal provided with a device according to the invention.

The device according to the invention is explained below with reference to the appended drawing, in which:

Figs. 1a-1e show diagrammatically in a view from above the circulation of holders in a conveyance circuit according to the invention;

Fig. 2 shows a diagrammatic side view of the conveyance circuit according to Fig. 1a;

Fig. 3 shows a side view of a part of an end section of a longitudinal path of the conveyance circuit; and

Fig. 4 shows a side view of a part of a transverse track of the conveyance circuit.

Figs. 1a to 1e show diagrammatically in top view the circulation route of containers C_m, E representing an empty position. The direction of circulation is indicated by arrows. A conveyance circuit is indicated by reference numeral 2, said conveyance circuit consisting of a longitudinal path 4 and a

longitudinal path 6, which is disposed parallel to and adjoining longitudinal path 4. See Fig. 2, which is a diagrammatic side view of the situation shown in Fig. 1a. The longitudinal paths 4 and 6 have opposite angles of inclination of approximately 0.2°, which is greatly exaggerated in this figure for the sake of clarity. For the sake of simplicity, transverse tracks are not shown in these Figures 1 and 2. In the situation shown, each longitudinal path has eight positions for carriers with containers. The longitudinal path 4 is filled with carriers with containers C_1 - C_8, while the longitudinal path 6 comprises containers C_9 - C_{15} and also has an empty position E that corresponds to the top end position of the longitudinal path 6. The carrier with container C_1 can be moved in a manner to be described in greater detail from the longitudinal path 4 to the empty position E of the longitudinal path 6, so that an empty position E arises in the lowest end position of the longitudinal path 4. See Fig. 1b. By their own weight, the carriers with containers C_2 - C_8 subsequently each drop one position, as shown in Fig. 1c, so that the empty position E now arises at the top end of the longitudinal path 4. The carrier with container C_9 can be lifted up on a vertically movable transverse track until it is above the top end of the longitudinal path 4 and can subsequently be moved along the transverse track to the top position of longitudinal path 4. See Fig. 1d. The empty position E, which is now situated at the bottom end of longitudinal path 6, will be filled by the series of containers C_{10} - C_1 moving under the influence of gravity, leading to the situation shown in Fig. 1e, from which it can be seen that all containers C have moved up one position. The cycle described above will be repeated during operation of the device according to the invention for the number of times that it takes for a desired container to be situated at a removal point 10, which is preferably the position at the bottom end of the top longitudinal path 4, while a supply point 12 is preferably the position at the top end of the bottom longitudinal path 6.

As shown in Fig. 3, each longitudinal path 4, 6 comprises a bearing structure along which a carrier 14 with container (not shown) can travel. For that purpose, the carrier 14 is provided with rows of wheels 16 which are spaced apart in the direction of travel, and of which only the outermost wheels of each row are visible in side view. The wheels 16 of a certain row can be mounted

on a common horizontal axle 18, or each wheel can be provided with its own axle. The resulting mobile carrier 14 is provided with suitable means for fixing the containers, for example of the type used for fixing on lorries or rail wagons, for example pins 24 which can be recessed in the top surface 22 of the carrier 14, which pins, for the fixing, project into fitted holes of the container. An end section 26 of a longitudinal path 4, 6 comprises guides 28, running parallel, viewed in the direction of travel, the number of which corresponds to the number of wheels 16 in a row. Open spaces 30 are present between the guides 28 in the end section 26. A number of piston/cylinder assemblies 34 are disposed vertically below these open spaces 30 in the guides 28 on the tier floor 32. A rotatable disc 40 is mounted on the head 36 of each piston 38 in such a way that it can rotate about a horizontal shaft 42, the direction of rotation of a rotatable disc 40 extending transversely to the longitudinal paths 4, 6, i.e. in the direction of movement of the transverse tracks. These rotatable discs 40 form the transverse tracks along which a carrier 14 can be moved from a longitudinal path 4 to an adjoining longitudinal path 6, and vice versa. On the underside of the carrier 14, inverted U-profiles 44 are fixed between the rows of wheels 16, which profiles extend across the entire width of a carrier 14 and ensure correct movement of the carrier 14 along the rotatable discs 40. In order to make the transverse movement possible when a carrier 14 is situated in the bottom end position of a longitudinal path, the pistons 38 are extended until the carrier 14 is no longer resting upon the guides 28, but is resting with the U-profiles 44 upon the rotatable discs 40 and is situated substantially in a horizontal position. A sloping track can be formed by subsequently operating in a controlled manner the rows of piston/cylinder assemblies disposed in the transverse direction of the transverse tracks, along which sloping track the carrier 14 will move under the influence of gravity until said carrier is situated above an end section of the adjoining longitudinal path 6, after which the carrier 14 is again taken substantially into a horizontal position by correct operation of the piston/cylinder assemblies and is subsequently placed in a position corresponding to the angle of inclination of the longitudinal path 6 and then set on the guides 28 by retraction of the pistons 38.

In order to prevent following carriers with containers from

resting against the carrier 14 with container in the end position and making it impossible for the latter to be moved into a horizontal position, spacers 46 are provided at the ends of the carriers 14, and blocking means, for example blocks 48 which can be recessed in the guides 28 and block further movement of the next carrier, can also be provided. When the last position is free, the blocking means 48 are put out of action, so that the series of carriers can move up one position in the longitudinal path.

Although the above description focuses on a storage device for containers, it will be understood that the device according to the invention can also be used for other holders, for example pallets.

CLAIMS

1. Device for storage and conveyance of bulky holders (C), comprising at least one tier (32), each tier comprising at least one conveyance circuit (2) for the holders (C), and each conveyance circuit (2) comprising at least two longitudinal paths (4, 6) disposed substantially parallel to each other, for conveyance of the holders (C) in the direction of the longitudinal paths (4, 6), which longitudinal paths (4, 6) each define a first predetermined number (N) of adjoining holder positions for the holders (C), while two adjacent longitudinal paths (4, 6) of a conveyance circuit (2) slope from the same end in opposite directions, and also comprising transverse tracks situated at the opposite ends of the longitudinal paths and movable at least in the vertical direction, for conveyance of the holders (C) in the direction of the transverse tracks, which transverse tracks can transfer the holders (C) to and from the longitudinal paths (4, 6), and also comprising a second predetermined number ($M \leq 2*N - 1$) of carriers (14) which are movable along the longitudinal paths and transverse tracks and are designed to take one or more holders (C), lifting means (34) being provided for moving the transverse tracks in the vertical direction.

2. Device according to claim 1, in which the carriers (14) are provided with rows of wheels (16) which are spaced apart and are rotatable in the longitudinal direction of the longitudinal paths (4, 6).

3. Device according to claim 2, in which at least end sections of the longitudinal paths (4, 6) comprise guides (28) for guiding the wheels (16) of the carrier (14), open spaces (30) being present between the guides (28).

4. Device according to one of the preceding claims, in which the transverse tracks are formed by rotatable discs (40) which are disposed one after the other in rows and are rotatable about a horizontal shaft (42) and in the longitudinal direction of a transverse track.

5. Device according to claim 4, in which a rotatable disc (40) is fixed on the head (36) of a piston/cylinder assembly (34).

6. Device according to claim 4 or 5, in which the underside of a carrier (14) between the rows of wheels (16) is provided with guides (44) for accommodating and guiding the rotatable discs (40).

7. Device according to one of the preceding claims, in which the carriers (14) are provided with spacers (46).

8. Device according to one of the preceding claims, in which the longitudinal paths (4, 6) are provided with blocking means (48) for retaining a carrier (14).

9. Device according to one of the preceding claims, provided with a supply point (12) and removal point (10) for feeding in and removing containers (C) respectively.

10. Device according to one of the preceding claims, in which the supply point (12) and removal point (10) are situated at the same end of the longitudinal paths (4, 6) of the device.

11. Device according to one of the preceding claims, in which the supply point (12) and removal point (10) are situated at the end of the longitudinal paths (4, 6) where the height difference between them is minimal.

12. Device according to one of the preceding claims, in which a detection system for detecting a unique code is present, which code (C_n) is placed on a holder (C).

13. Device according to one of the preceding claims, in which each conveyance circuit (2) comprises two parallel longitudinal paths (4, 6), and each tier (32) comprises several conveyance circuits (2) disposed next to each other.

14. Device according to one of the preceding claims, provided with a further conveyor, which moves along each supply and removal point (12, 10) of a conveyance circuit (2), and over which lifting means for conveying holders are disposed in a movable manner.

15. Device according to one of the preceding claims, in which the second predetermined number (M) of carriers (14) movable along the longitudinal paths and transverse tracks is equal to twice the first predetermined number (N) of holder positions of a longitudinal path (4, 6) adjoining each other, minus one.

16. Container terminal provided with a device according to one of the preceding claims.

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
A00-40071/JV		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00518	21/07/2000	23/07/1999
International Patent Classification (IPC) or national classification and IPC B65G1/06		
Applicant FOUNTAIN TECHNOLOGIES B.V. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
16/01/2001	14.11.2001
Nam and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 pmu d Fax: +49 89 2399 - 4465	Authorized officer Samwel, P Telephon No. +49 89 2399 2099

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL00/00518

I. Basis f th r p rt

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-9 as originally filed

Claims, No.:

1-16 as originally filed

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ th claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-16
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-16
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-16
	No:	Claims	

2. Citations and explanations
see separate sheet

1) Reference is made to the following documents:

D1: US-A- 5 123 517
D2: US-A- 3 749 268

2) The only independent claim 1 deals with a device for storage and conveyance of bulky holders. The closest prior art is D2 and the subject-matter of claim 1 differs from D2 in that a vertical movement is possible to convert the holders from one to the other tier. Vertical movement for transport is known as such (see D1), but here the transport is only foreseen along the tier and therefore it is considered not obvious for the man skilled in the art to come from D1 and D2 to the subject-matter of claim 1.

3) Contrary to the requirements of Ruke 5.1.(a) ii PCT, the relevant background art disclosed in the documents D1, D2 are not mentioned in the discription, nor are these documents identified therein.

4) Independent claim 1 is not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D2) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).